HOWARD W. SAMS & COMPANY CD20 09038

COMPUTERFACTS™

Technical Service Data

COMMODORE®
MODEL 1541-II
DISK DRIVE

FEATURES COMPLETE SCHEMATICS • PRELIMINARY SERVICE CHECKS • TROUBLESHOOTING TIPS • EASY-READ WAVEFORMS • REPLACEMENT PARTS LISTS • SEMICONDUCTOR CROSS-REFERENCE

PRELIMINARY SERVICE CHECKS

This data provides the user with a time-saving service tool which is designed for quick isolation and repair of Disk Drive malfunctions.

Check all interconnecting cables for good connection and correct hook-up before making service checks.

Always turn the Disk Drive Off before connecting or disconnecting connectors.

Replacement or repair of the Motor Control Board or Main Board may be necessary after the malfunction has been isolated.

Remove four screws from cabinet bottom which hold cabinet top. Lift cabinet top from unit. Pull knob from front of unit. Lift up on the front panel and pull it forward. Remove one screw from front panel holding LED Board. Disconnect Connectors CN2, CN3 and CN4 from Main Board. Remove four screws holding Drive Mechanism to cabinet bottom and remove mechanism. Remove three screws holding Main Board and remove board.

CD20 COMMODORE MODEL 1541-II

GENERAL OPERATING INSTRUCTIONS

DIRECTORY

To get a Directory (list of programs on a diskette) type LOAD "$",8 and press the RETURN key. After the Directory is loaded, type LIST and press the RETURN key to list the Directory on the Monitor screen.

INITIALIZING THE DRIVE (RESET)

To initialize the Disk Drive, type OPEN 15,8,15,"I":CLOSE 15 and press the RETURN key. If a FILE OPEN error message appears on the screen, it means that file 15 has been already opened by a previous operation and was not properly closed. Type CLOSE 15 and press the RETURN key, then repeat the initializing procedure.

LOADING PROGRAMS

To load a program from the Disk Drive, type LOAD with the Program Name enclosed in quotes, followed by a ,8 and press the RETURN key. Example: LOAD "SAMS" ,8.

SAVING PROGRAMS

To save a program to the Disk Drive, type SAVE with the Program Name enclosed in quotes, followed by a ,8 and press the RETURN key. Example: SAVE "SAMS" ,8.

FORMATTING A DISKETTE

A blank diskette must be formatted before it will work in the Disk Drive. To format a diskette, insert a blank diskette into the Disk Drive and close the door. Type the following with a name for the diskette and a two character identification code enclosed in the quotes with NO:. Then, press the RETURN key. Example: OPEN 1,8,15,"NO:NAME,ID"CLOSE 1

DISK DRIVE ERROR SIGNAL (BLINKING LED)

If the LED (RED) (CR20) on the front panel of the Disk Drive starts blinking, it means an error in operation has occurred and an error message has been stored in the Disk Drive memory. Use the following program to read and display the error message. The program displays the error number, message, track and sector where the error has occurred.

```
10 OPEN 15,8,15
20 INPUT #15,EN,E$,T,S
30 PRINT "ERROR #";EN,E$
40 PRINT "TRACK #";T,"SECTOR #";S
50 CLOSE 15
```

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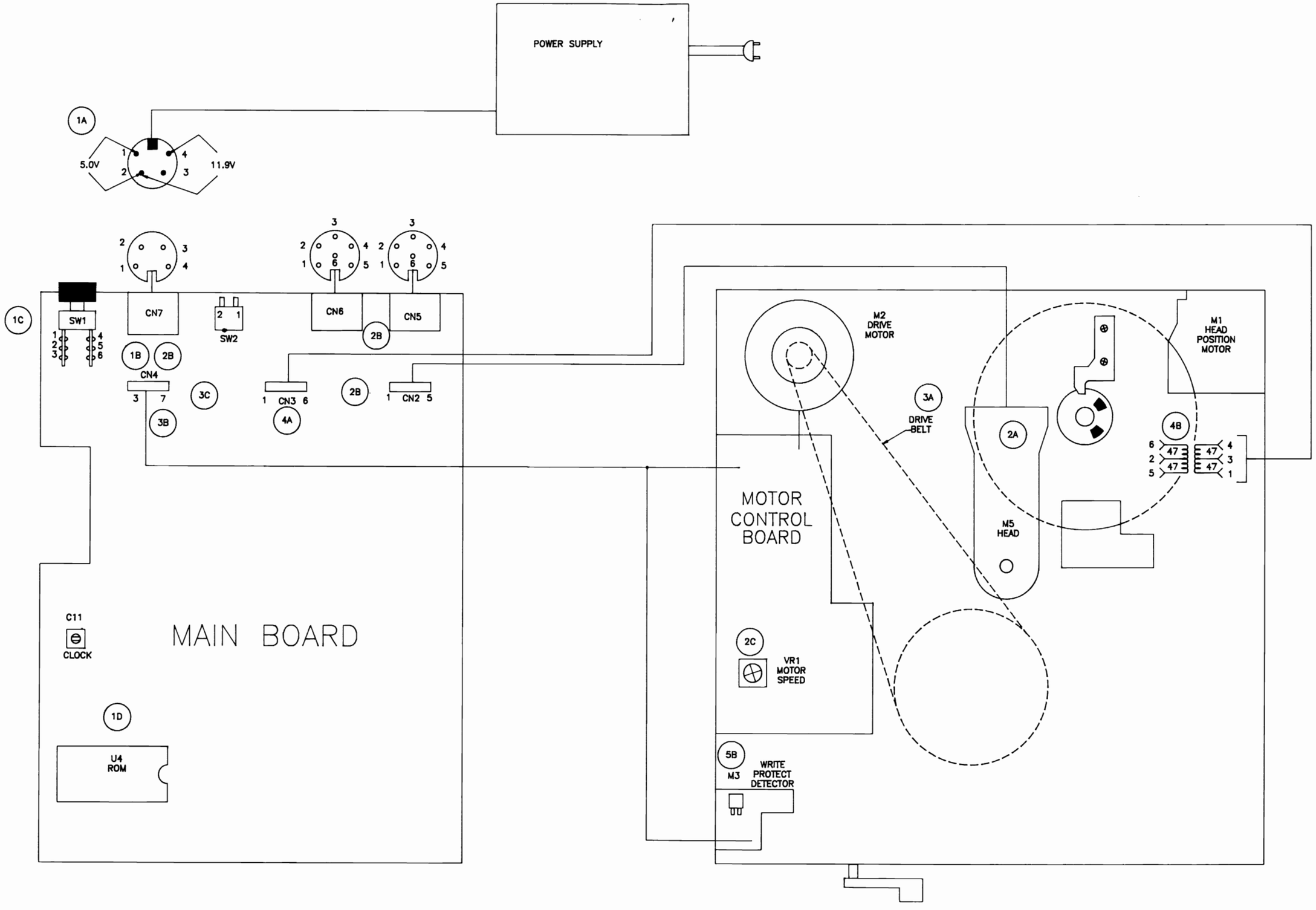
PRELIMINARY SERVICE CHECKS (Continued)



INTERCONNECTING DIAGRAM

PRELIMINARY SERVICE CHECKS (Continued)

SERVICE CHECKS

MATCH THE NUMBERS ON THE INTERCONNECTING DIAGRAM AND PHOTOS WITH THE NUMBERS ON THE SERVICE CHECKS TO BE PERFORMED.

(1.) DRIVE IS DEAD

(A) Check for 5.0V at pin 1 and 11.9V at pin 4 of Power Supply Connector. If voltages are missing, replace Power Supply.

(B) If Power Supply checks good, check Connector CN4 for good connections.

(C) Disconnect Power Supply from Drive and turn Power Switch SW1 On. Check SW1 contacts for continuity from pin 1 to pin 2 and pin 4 to pin 5.

(D) Check ROM IC U4 by substitution.

(2.) DRIVE OPERATION IS ERRATIC

Check for possible interference from Monitor or other electronic equipment. Position Disk Drive away from Monitor or other equipment and recheck operation of Drive.

(A) Clean Head (M5) with a cotton swab or lint free cloth dampened with 91% Isopropyl alcohol and dry with a lint free cloth.

(B) Check Connectors CN2 thru CN7 for good connections.

(C) Check Motor Speed adjustment. See "Miscellaneous Adjustments".

(3.) DRIVE MOTOR IS DEAD

(A) Check Drive belt.

(B) Check pins 5, 6 and 7 of Connector CN4 for good connections.

(C) Connect a jumper from pin 7 of Connector CN4 to ground. If Drive motor starts running, troubleshoot Main Board. If motor is still dead, troubleshoot Motor Control Board.

(4.) HEAD POSITION MOTOR IS DEAD

(A) Check Connector CN3 for good connections.

(B) Check Head Position Motor windings for continuity.

(5.) WRITE PROTECT DOES NOT WORK

Type in and run the following Basic program to check operation of write protect circuit:

```
10 OPEN 15,8,15
20 PRINT#15,"MR"CHR$(0)CHR$(28)CHR$(1)
30 GET #15,A$
40 A=ASC(A$) AND 16
50 PRINT A:GOTO 20
```

NOTE: Do not put any spaces in line 20.

The program displays a number on the Monitor screen. The number should be 16 if a diskette that is not write protected is inserted in the Drive and 0 if the diskette is write protected.

(A) If the numbers are not correct, check pins 3 and 4 of Connector CN4 for good connections.

(B) If the connectors check good, check Light Emitting Diode LED1 and Write Protect Detector M3.

PRELIMINARY SERVICE CHECKS (Continued)
SAFETY PRECAUTIONS

1. Use an isolation transformer for servicing.

2. Maintain AC line voltage at rated input.

3. Remove AC power from the Disk Drive before servicing or installing electrostatically sensitive devices. Examples of typical ES devices are integrated circuits and semiconductor "chip" components.

4. Use extreme caution when handling the printed circuit boards. Some semiconductor devices can be damaged easily by static electricity. Drain off any electrostatic charge on your body by touching a known earth ground. Wear a commercially available discharging wrist strap device. This should be removed prior to applying power to the unit under test.

5. Use a grounded-tip, low voltage soldering iron.

6. Use an isolation (times 10) probe on scope.

7. Do not remove or install boards with AC power On.

8. Do not use freon-propelled sprays. These can generate electrical charges sufficient to damage semiconductor devices.

9. This Disk Drive is equipped with a grounded three-pronged AC plug. This plug must fit into a grounded AC power outlet. Do not defeat the AC plug safety feature.

10. Periodically examine the AC power cord for damaged or cracked insulation.

11. The Disk Drive cabinet is equipped with vents to prevent heat build-up. Never block, cover, or obstruct these vents.

12. Instructions should be given, especially to children, that objects should not be dropped or pushed into the vents of the cabinet. This could cause shock or equipment damage.

13. Never expose the Disk Drive to water. If exposed to water turn the unit off. Do not place the Disk Drive near possible water sources.

14. Never leave the Disk Drive unattended or plugged into the AC outlet for long periods of time. Remove AC plug from AC outlet during lightning storms.

15. Do not allow anything to rest on AC power cord.

16. Unplug AC power cord from outlet before cleaning Disk Drive.

17. Never use liquids or aerosols directly on the Disk Drive. Spray on cloth and then apply to the Disk Drive cabinet. Make sure the Disk Drive is disconnected from the AC power line.

DISASSEMBLY INSTRUCTIONS

Remove four screws from cabinet bottom which hold cabinet top. Lift cabinet top from unit. Pull knob from front of unit. Lift up on the front panel and pull it forward. Remove one screw from front panel holding LED Board. Disconnect Connectors CN2, CN3 and CN4 from Main Board. Remove four screws holding Drive Mechanism to cabinet bottom and remove mechanism. Remove three screws holding Main Board and remove board.

SWITCHES

DISK DRIVE DEVICE NUMBER

The number 8 used in the load and save procedures is the device number assigned to the Disk Drive. The device number can be set to any number from 8 to 11 by setting Device switch SW2 on rear of Disk Drive. The switch closest to the Serial Interface connectors is SW2-1. The up position is On, down is Off. Use the following chart to determine switch settings for desired device number.

DEVICE NUMBER	SWITCH SW2-1	SWITCH SW2-2
8	ON	ON
9	OFF	ON
10	ON	OFF
11	OFF	OFF

MOTOR SPEED ADJUSTMENT

Center and paste a strobe pattern (see Figure 1) on the spindle pulley on bottom of Drive. Insert a diskette into Disk Drive and close Drive door. Load a program from diskette or connect a jumper from pin 7 of Connector CN4 to ground to keep Drive running. Use the outer trace of pattern on spindle pulley if 60 HZ AC power is being used or use inner trace of pattern if 50 Hz AC power is being used. Use a fluorescent light to view the pattern. Adjust Speed Control VR1 until pattern appears to stand still or barely moves.

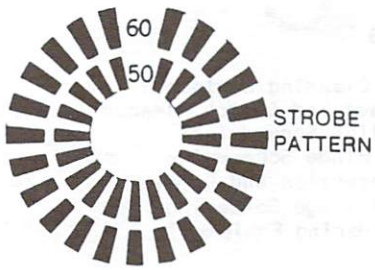


FIGURE 1

PRELIMINARY SERVICE CHECKS (Continued)

DISK DRIVE DEVICE NUMBER

The number 8 used in the load and save procedures is the device number assigned to the Disk Drive. The device number can be set to any number from 8 to 11 by setting Device switch SW2 on rear of Disk Drive. The switch closest to the Serial Interface connectors is SW2-1. The up position is On, down is Off. Use the following chart to determine switch settings for desired device number.

DEVICE NUMBER	SWITCH SW2-1	SWITCH SW2-2
8	ON	ON
9	OFF	ON
10	ON	OFF
11	OFF	OFF

CLOCK FREQUENCY

Connect input of a frequency counter to pin 21 of Gate Array IC (U10). Adjust Trimmer C11 for a frequency of 16.0MHz.

HEAD CLEANING INSTRUCTIONS

Use a lint free cloth or swab dampened with 91% isopropyl alcohol to clean disk drive heads and dry with a lint free cloth.

TEST EQUIPMENT AND TOOLS

TEST EQUIPMENT

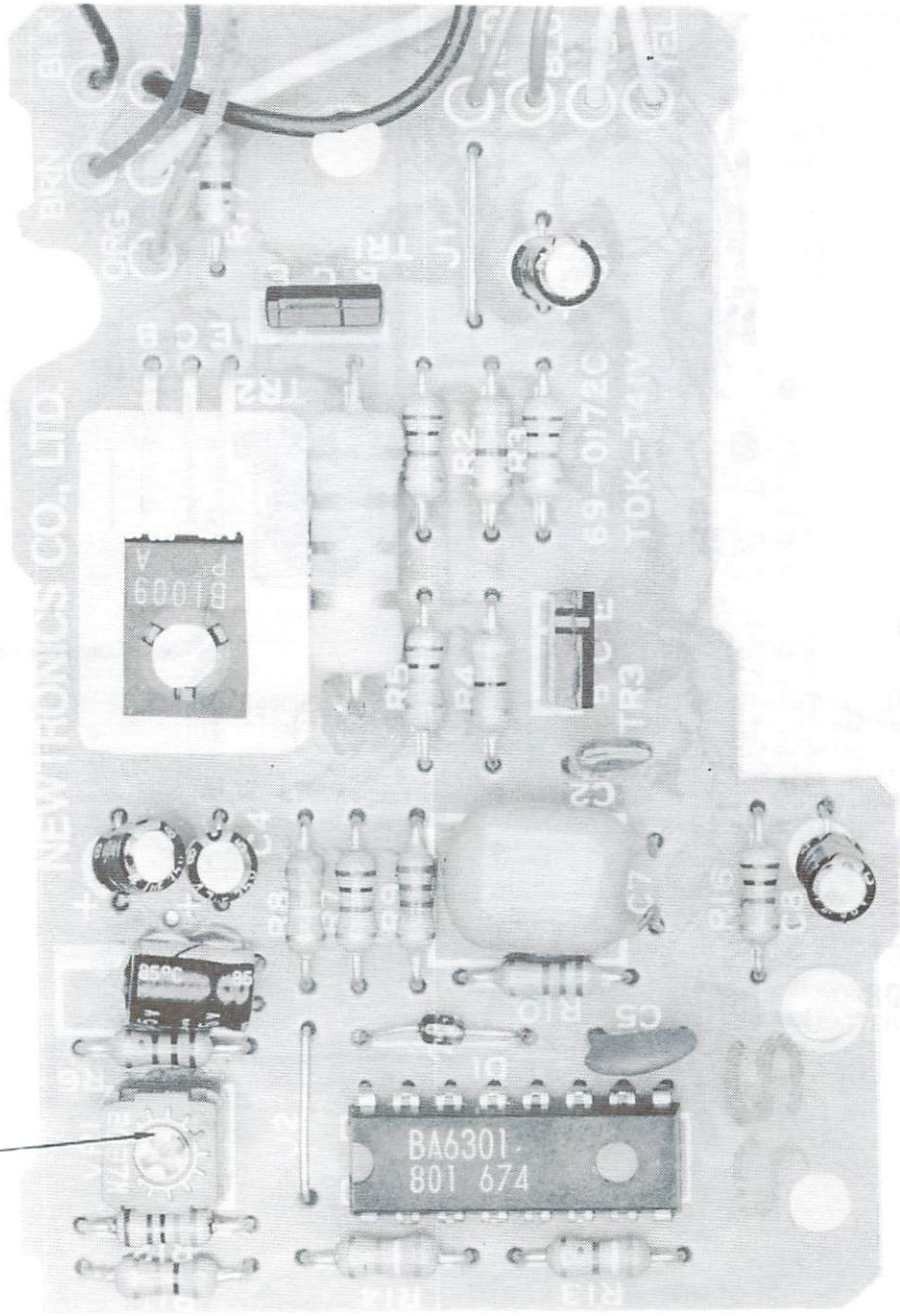
Digital Volt/Ohm Meter
Logic Probe
Frequency Counter
Disk Drive Tester or Test Program
Logic Pulser

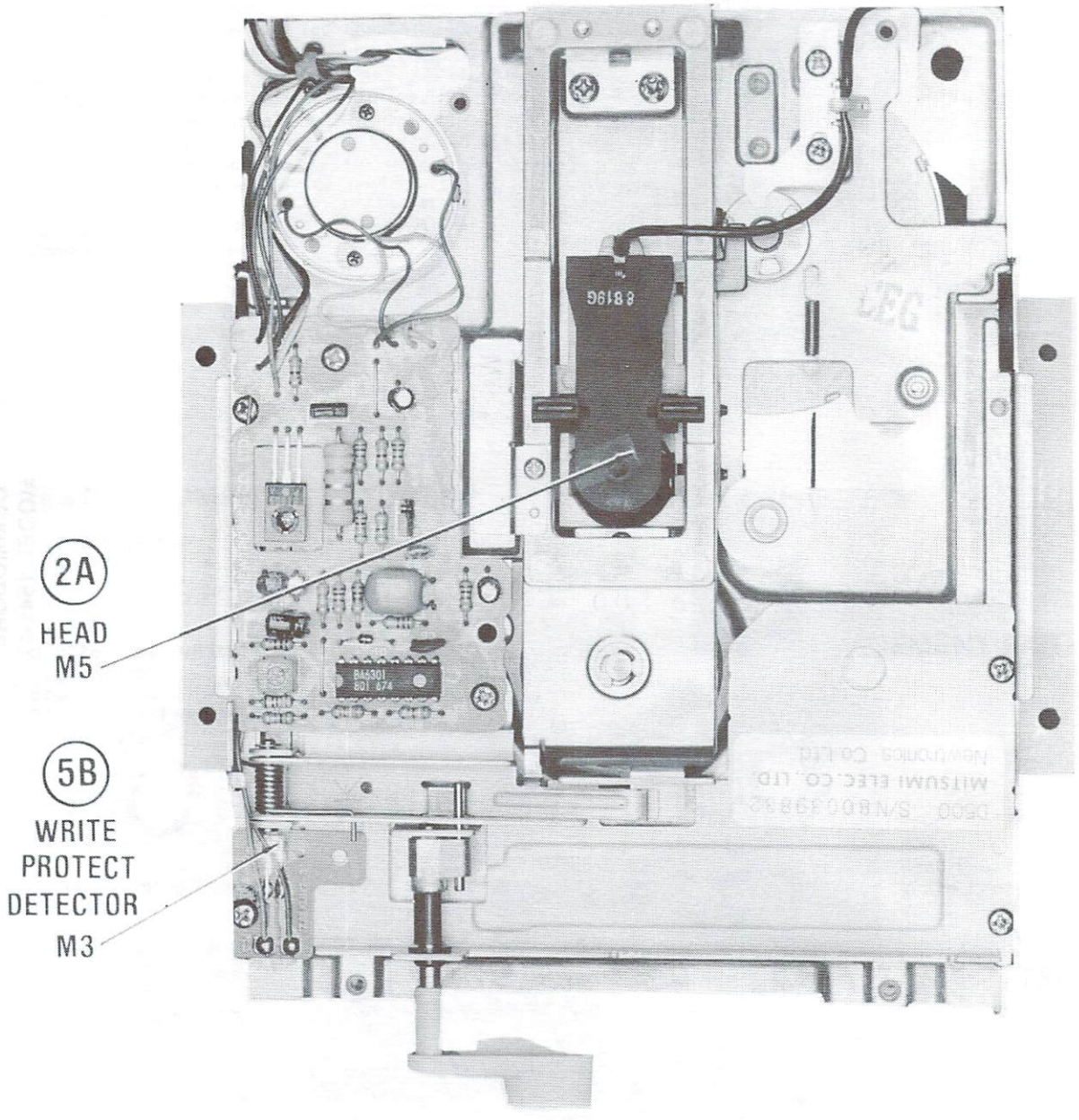
TOOLS

Head Cleaning Equipment
Contact and Switch Cleaner (non spray type)
Phillips Screwdriver
Flat Blade Screwdriver
IC Insertion and Removal Tools 24 and 28 pin
Low Voltage Soldering Iron
Desoldering Equipment

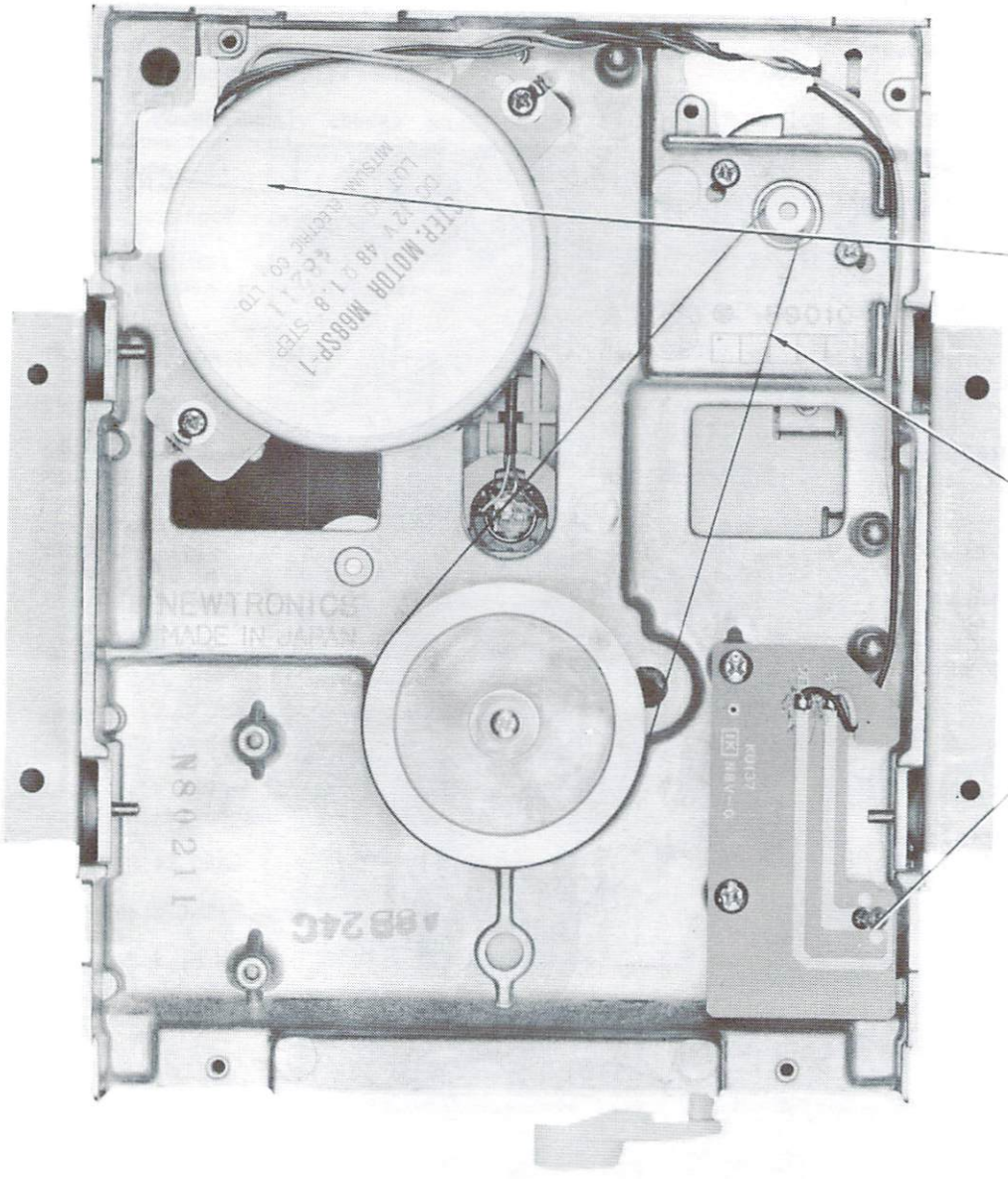
REPLACEMENT PARTS

ITEM	PART NO.	DESCRIPTION
SW1		Power Switch
U4	251968-03	ROM
M1	M68SP-1	Head Position Motor
LED 1		Write Protect LED
M3		Write Protect Detector


2C
VR1
MOTOR
SPEED
BA6301
801 674

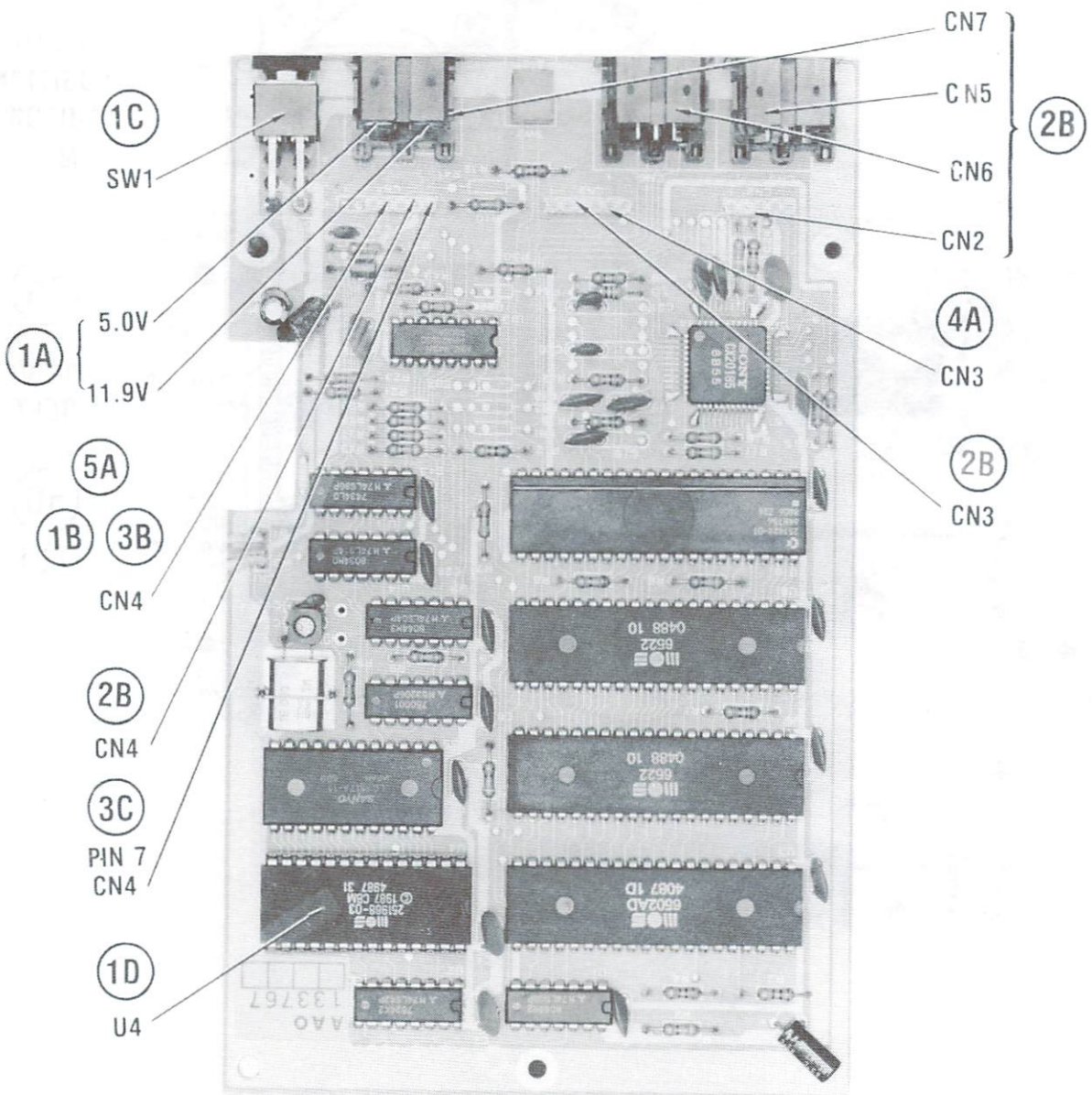


MECHANICAL-TOP VIEW



COMMODORE
MODEL 1541-II

MECHANICAL-BOTTOM VIEW


CN7
CN5
CN6
CN2
2B
1C
SW1
5.0V
1A
11.9V
4A
CN3
5A
2B
CN3
1B
3B
CN4
2B
CN4
3C
PIN 7
CN4
1D
U4

SEE PAGE II

PRELIMINARY SERVICE CHECKS (Continued)
PREVENTATIVE MAINTENANCE

ENVIRONMENT

Computers perform best in a clean, cool area that is below 80 degrees Fahrenheit and free of dust and smoke particles. Even though home Computers are not affected by cigarette smoke as much as commercial Computers are affected, it is better to mantain a smoke-free area around the Computer. Do not block cabinet vents of Computer, Monitor, Printer, or other power devices.

ELECTRICAL POWER

Variations in the line voltage can affect the Computer. Try to avoid these fluctuations by using an AC receptacle that is on a power line not used by appliances or other heavy current demand devices. A power-surge protector, power-line conditioner, or non-interruptable power supply may be needed to cure the problem. **Do not** switch power On and Off frequently.

KEYBOARD

Liquids spilled into the Keyboard can ruin it. Immediately after a spill occurs, disconnect the Computer power plug from AC power outlet. Then, if circuitry or contacts are contaminated, disassemble the Keyboard and carefully rinse the Keyboard printed circuit board with distilled water and let it dry. Use a cotton swab to clean between the keys. Use a non-abrasive contact cleaner and lint-free wipers on accessible connectors and contacts.

DISK DRIVES

Clean the read/write heads of the Disk Drives about once a month or after 100 hours usage. Use only an approved head cleaning kit.

Handle carefully to preserve proper disk head alignment. A sudden bump or jolt to the Disk Drives can knock the disk head out of alignment. If Disk Drive must be transported, place an old disk in slot and close door during transport.

Store disks in their protective covers and never touch the disk surface. Observe the disk handling precautions usually found on the back of disk protective covers.

PRINTERS

Carefully vacuum the Printer regularly. Wipe surface areas clean using a light all-purpose cleaner. Do not oil the machine. The oil will collect abrasive grit and dust. The dust will act as a blanket. This can cause components to overheat and fail.

STATIC ELECTRICITY

Static electricity discharge can affect the Computer. In order to minimize the possibility, use anti-static mats, sprays, tools and materials, and maintain good humidity in the Computer environment.

MONITOR

Use an isolation transformer with any Monitor that does not come as part of the system since some Monitors use a HOT chassis (chassis connected to one side of the AC line). The face of the Monitor should never be left on for long period of time at high brightness level except when pattern is being changed periodically. Use caution when cleaning anti-glare screens, to preserve the glare-reduction feature.

COMMODORE MODEL 1541-II
CD20

CD20
COMMODORE MODEL 1541-II

SAFETY PRECAUTIONS

See Page 4.

PRELIMINARY SERVICE CHECKS

ENCLOSED

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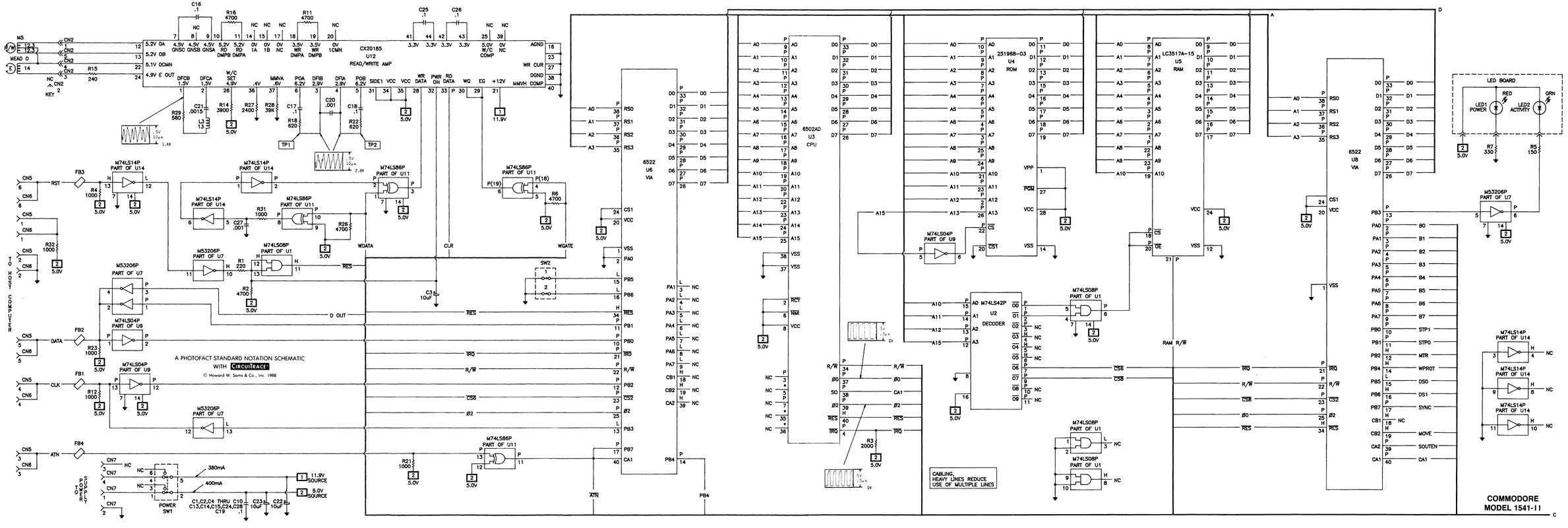
CD20
COMMODORE
MODEL 1541-11
6522
U6
VIA
6502AD
U3
CPU
251968-03
U4
ROM
LC3517A-15
U5
RAM
U2
DECODER
U12
READ/WRITE AMP
CX20185
M74LS14P
PART OF U14
M74LS86P
PART OF U11
M74LS04P
PART OF U9
M74LS08P
PART OF U1
M53206P
PART OF U7
M74LS42P
SW2
POWER
SW1
LED BOARD
RED
GRN
LED1
POWER
LED2
ACTIVITY
A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE
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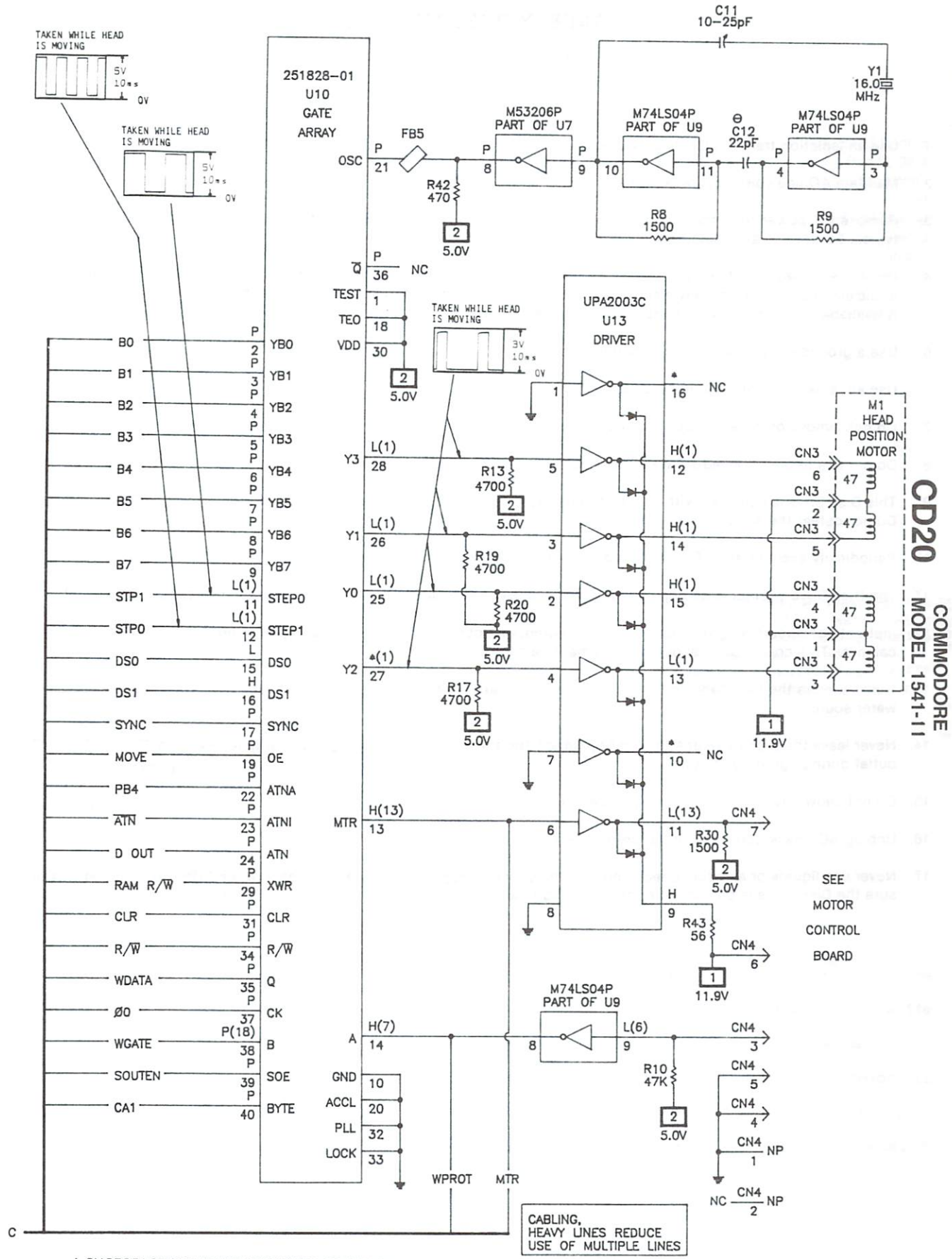
CABLING,
HEAVY LINES REDUCE
USE OF MULTIPLE LINES
COMMODORE
MODEL 1541-11



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SAFETY PRECAUTIONS

1. Use an isolation transformer for servicing.

2. Maintain AC line voltage at rated input.

3. Remove AC power from the Disk Drive before servicing or installing electrostatically sensitive devices. Examples of typical ES devices are integrated circuits and semiconductor "chip" components.

4. Use extreme caution when handling the printed circuit boards. Some semiconductor devices can be damaged easily by static electricity. Drain off any electrostatic charge on your body by touching a known earth ground. Wear a commercially available discharging wrist strap device. This should be removed prior to applying power to the unit under test.

5. Use a grounded-tip, low voltage soldering iron.

6. Use an isolation (times 10) probe on scope.

7. Do not remove or install boards with AC power On.

8. Do not use freon-propelled sprays. These can generate electrical charges sufficient to damage semiconductor devices.

9. This Disk Drive is equipped with a grounded three-pronged AC plug. This plug must fit into a grounded AC power outlet. Do not defeat the AC plug safety feature.

10. Periodically examine the AC power cord for damaged or cracked insulation.

11. The Disk Drive cabinet is equipped with vents to prevent heat build-up. Never block, cover, or obstruct these vents.

12. Instructions should be given, especially to children, that objects should not be dropped or pushed into the vents of the cabinet. This could cause shock or equipment damage.

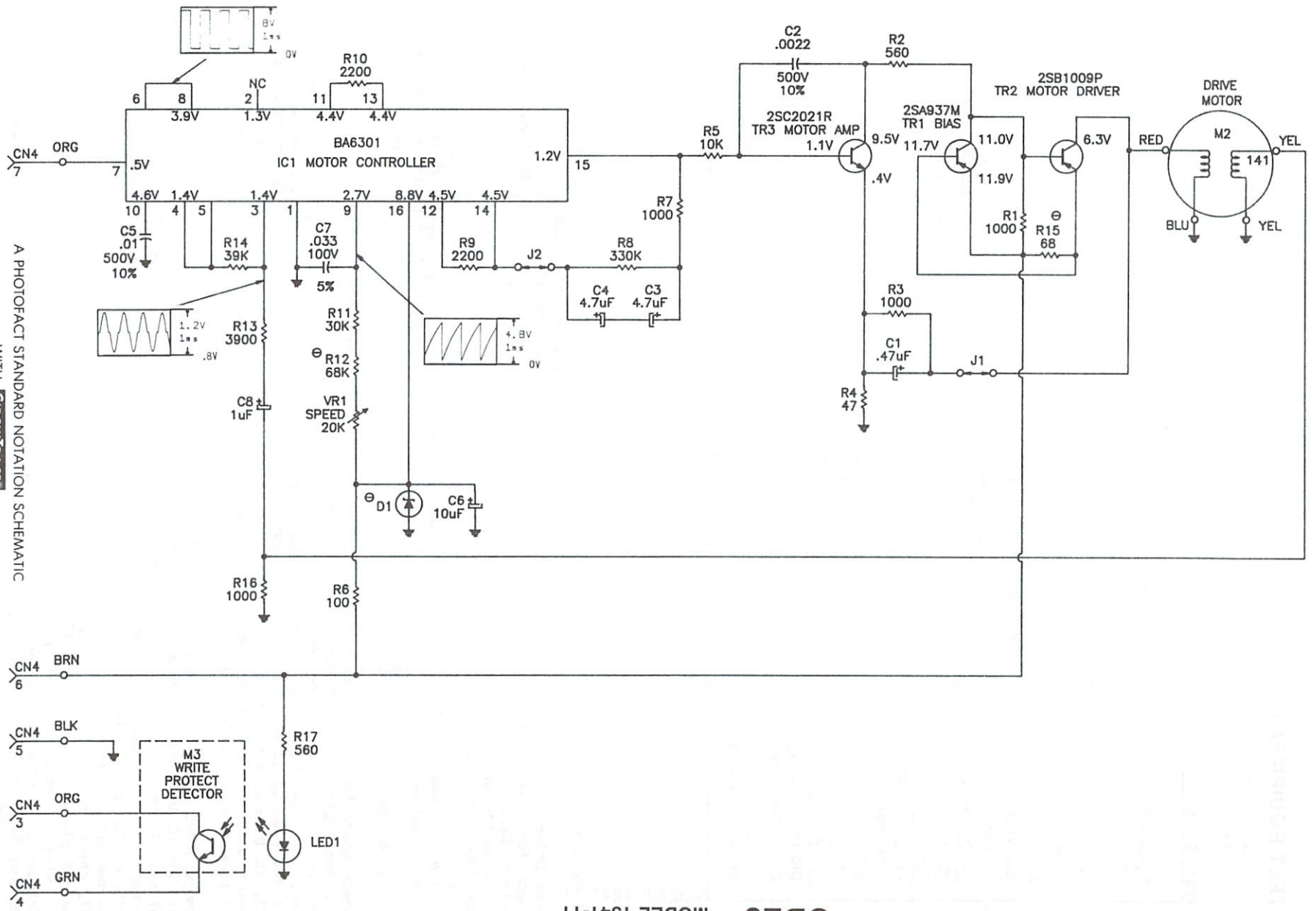
13. Never expose the Disk Drive to water. If exposed to water turn the unit off. Do not place the Disk Drive near possible water sources.

14. Never leave the Disk Drive unattended or plugged into the AC outlet for long periods of time. Remove AC plug from AC outlet during lightning storms.

15. Do not allow anything to rest on AC power cord.

16. Unplug AC power cord from outlet before cleaning Disk Drive.

17. Never use liquids or aerosols directly on the Disk Drive. Spray on cloth and then apply to the Disk Drive cabinet. Make sure the Disk Drive is disconnected from the AC power line.



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MOTOR CONTROL

CD20 COMMODORE MODEL 1541-11

TEST EQUIPMENT

Test Equipment listed by Manufacturer illustrates typical or equivalent equipment used by SAMS' Engineers to obtain measurements and is compatible with most types used by field service technicians.

TEST EQUIPMENT

Equipment	B & K Precision Equipment No.	Sencore Equipment No.	Notes
OSCILLOSCOPE	1570A,1590A,1596	SC61	
LOGIC PROBE	DP51,DP21		
LOGIC PULSER	DP101,DP31		
DIGITAL VOM	2830,2806	DVM37,DVM56,SC61	
ANALOG VOM	277,111,116		
ISOLATION TRANSFORMER	TR110,1604,1653,1655	PR57	
FREQUENCY COUNTER	1803,1805	FC71,SC61	
COLOR BAR GENERATOR	1211A,1251,1260,1249	CG25,VA62	
RGB GENERATOR	1260,1249		
FUNCTION GENERATOR	3020,3011,3030		
HI-VOLTAGE PROBE VOM/DMM Accessory probes	HV-44 PR-28(HV)	HP200	
TEMPERATURE PROBE	TP-28,TP-30		
CRT ANALYZER	467,470	CR70	
DIGITAL IC TESTER	560,550,552		
CAPACITANCE ANALYZER		LC53,LC75,LC76 LC77	
INDUCTANCE ANALYZER		LC53,LC75,LC76 LC77	

TROUBLESHOOTING

POWER SUPPLY

Disk Drive is dead. With Power Switch SW1 On, check for 5.0V at pin 2 and 11.9V at pin 5 of Switch SW1. If either voltage is missing, check Switch SW1 for continuity, check Connector CN7 for good connections and check the Power Supply. If voltages are present, refer to the "CPU Operation" section of this Troubleshooting guide.

CPU OPERATION

Check operation of the reset circuit by checking the logic reading at pin 11 of IC U1 while turning Drive On. The reading should be logic low, then immediately go high and stay high. If the reading is not correct, check Capacitor C3, IC U1 and Resistor R2. If Drive does not reset when a Computer connected to the Drive is turned On, check IC's U7 and U14.

Check 1 MHz clock waveforms at pins 37 and 39 of CPU IC U3. If waveform is present at pin 37 and missing at pin 39, check IC U3. If frequency is not correct, check adjustment of Trimmer Capacitor C11 (see "Miscellaneous Adjustments"). If waveform is missing at pin 37, check for a 5.0V peak to peak, 16 MHz signal at pin 21 of Gate Array IC U10. If signal is missing, check Crystal Y1, Capacitor C12, Trimmer C11, IC's U7 and U9 and Resistors R8, R9 and R42. If signal is present at pin 21, check IC U10.

If reset and clock circuits check good, check for pulses on Data pins (26 thru 33) of CPU IC U3. If pulses are missing, check IC U3. If pulses appear when Drive is first turned On, then suddenly stop, check the ROM IC U4 and RAM IC U5.

Check output pins (1, 2, 7 and 9) of Decoder IC U2 with a logic probe while turning Drive on. Pin 1 should have pulses as soon as Drive is turned On and stay pulsing. Pin 2 should pulse momentarily when Drive is turned On, go high for about one second, pulse again, then go high and stay high. Pin 7 should pulse momentarily when Drive is turned On, then go high for about one second, then pulse and continue pulsing. Pin 9 should be high for about one second after Drive is turned On, then pulse and continue pulsing. If the reading on one pin is not correct, check IC U2. If readings are not correct on any pin, check IC U2, CPU IC U3 and ROM IC U4.

Check Data and Clock buffers connected to pins 4 and 5 of Connector CN5. Use a Logic Pulser to inject pulses at inputs of buffers (IC's U7 and U9) and check for pulses at outputs.

WILL NOT READ

Connect a jumper from pin 7 of Connector CN4 to ground to keep Drive running. Check for a logic low at pin 4 and high at pin 6 of IC U11. If the reading is not correct at pin 4,

check Gate Array IC U10. If the reading is correct at pin 4 and not correct at pin 6, check IC U11. Insert a diskette (with data on it) into Drive and close Drive door. Check the waveforms at pins 3 and 4 of Read/Write Amp IC U12. If the waveforms are missing, check Drive Head windings for continuity, check Connector CN2 for good connections and check voltages and components associated with pins 1 thru 44 of IC U12. If waveforms are present, observe pulses at pin 33 of IC U12 with a scope while opening and closing Drive door. Set scope sweep to 10us. There should be a noticeable change in the waveform. If there is no change or pulses are missing, check voltages and components associated with IC U12. If pulses check good at pin 33, check IC°s U10 and U6.

WRITE PROTECT DOES NOT WORK

Type in and run the following Basic program to check the operation of the write protect circuit:

```
10 OPEN 15,8,15
20 PRINT#15,"MR"CHR$(0)CHR$(28)CHR$(1)
30 GET #15,A$
40 A=ASC(A$) AND 16
50 PRINT A:GOTO 20
```

NOTE: Do not put any spaces in line 20.

The program displays a number on the Monitor screen. The number should be 16 if a diskette that is not write protected is inserted in the Drive and 0 if the diskette is write protected.

If the numbers are not correct, check for a logic high at pin 9 of IC U9 with a write protected diskette in the Drive and a logic low with a diskette that is not write protected. If the readings are not correct, check Light Emitting Diode LED1, Write Protect Detector M3 and check pins 3 and 4 of Connector CN4 for good connections. If the readings are good, check for a logic low at pin 8 of IC U9 with a write protected diskette in the Drive and a logic high with a diskette that is not write protected. If the readings are not correct, check IC U9. If the readings are correct, check VIA IC U8.

WILL NOT WRITE

Verify that write protect circuits are working properly (see "Write Protect Does Not Work"). If the write protect circuits are working, use a Logic Pulser to inject pulses at pin 1 of IC U11. While injecting pulses, check for pulses at pins 2, 3 and 8 of IC U11. If pulses are missing at pin 8, check IC U11. If pulses are present at pin 8 and missing at pin 2, check Capacitor C27, Resistor R31 and IC U14. If pulses are present at pins 2 and 8 and missing at pin 3, check IC U11. If pulses are present at all three pins, inject pulses at pin 4 and check for pulses at pin 6 of IC U11. If pulses are missing, check IC U11. If pulses are present, check IC U10 and check voltages and components associated with pins 1 thru 44 of Read/Write Amp IC U12.

HEAD POSITION MOTOR DOES NOT WORK

Check Connector CN3 for good connections and check Head Position Motor (M1) windings for continuity. If connector and motor check good, connect a computer to the Drive and type in and run the following Basic program to activate the Head Position Motor circuits:

```
10 OPEN 15,8,15,"I"
20 OPEN 8,8,8,"#"
30 PRINT#15,"U1:"8;0;1;0
40 PRINT#15,"U1:"8;0;30;0
50 GOTO 30
```

NOTE: Do not put any spaces in lines 30 or 40.

While the program is running, check for pulses at pins 2, 3, 4 and 5 of IC U13. If pulses are missing, check Gate Array IC U10. If pulses are present, check IC U13 and Motor M1.

DRIVE MOTOR DOES NOT WORK

Check the Drive Belt. If the Belt checks good, check pins 5, 6 and 7 of Connector CN4 for good connections and check Drive Motor (M2) windings for continuity (the primary winding should measure between 7 and 20 ohms). If the connector and motor check good, type in and run the program listed under "Head Position Motor Does Not Work". While the program is running, check for a logic high at pin 6 and low at pin 11 of IC U13. If the reading is not correct at pin 6, check Gate Array IC U10. If the reading is correct at pin 6 and not correct at pin 11, check IC U13. If the readings are correct, check waveforms, voltages and components associated with pins 1 thru 16 of Motor Controller IC IC1, Bias Transistor TR1, Motor Amp Transistor TR3 and Motor Driver Transistor TR2.

ALIGNMENT

ALIGNMENT TEST SETUP

Use a Dysan Analog Alignment Diskette 208-10 when an alignment diskette is specified in alignment procedures. NOTE: This alignment diskette has only alignment patterns on it and does not contain any alignment programs.

Use the following Track Seek program and procedure to step the Head to a specific track when specified in alignment procedure.

```
10 OPEN 15,8,15,"I"
20 OPEN 8,8,8,"#"
30 PRINT "TYPE 99 TO EXIT"
40 INPUT "TRACK ";T
50 IF T=99 THEN 90
60 T=T+1
70 PRINT#15,"U1:"8;0;T;0
80 GOTO 30
90 CLOSE 15:CLOSE 8
```

NOTE: Device Switch SW2 must be set to Device 8 (both switches up). Do not put any spaces in line 70.

With NO diskette in Disk Drive, run the above program and enter the number of the desired track. The Disk Drive will try to find the track, then go back to Track 00 and pause. It will then go to the specified track and stop. After Disk Drive stops, insert Alignment Diskette and close Drive Door. Connect a jumper from pin 7 (orange wire) of Connector CN4 to ground to keep Disk Drive running and perform alignment procedure. Whenever Drive Head must be set to a different track, remove jumper from pin 7 of Connector CN4 to stop Disk Drive and remove Alignment Diskette.

MOTOR SPEED ADJUSTMENT

Center and paste a strobe pattern (see Figure 1) on the spindle pulley on bottom of Drive. Insert a diskette into Disk Drive and close Drive door. Load a program from diskette or connect a jumper from pin 7 of Connector CN4 to ground to keep Drive running. Use the outer trace of pattern on spindle pulley if 60 HZ AC power is being used or use inner trace of pattern if 50 Hz AC power is being used. Use a fluorescent light to view the pattern. Adjust Speed Control VR1 until pattern appears to stand still or barely moves.

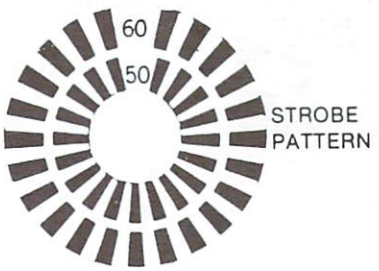


FIGURE 1

RADIAL HEAD ALIGNMENT

Connect channel A input of a dual trace scope to TP1 (pin 3 of Read/Write Amp IC U12). Connect channel B input to TP2 (pin 4 of IC U12). Set scope to add mode with channel B inverted, sweep time to 20 msec, voltage to 2V/cm range and the scope inputs to AC input. Set Drive Head to Track 16 (see "Alignment Test Setup"). Insert Alignment Diskette into Drive and connect a jumper from pin 7 of Connector CN4 to ground to keep Drive running. Observe cats-eye pattern (see Figure 2). The peak to peak amplitude of the lobes should be within 70% of each other. If lobes are out of tolerance, loosen the two screws holding Head Position Motor (M1) on the bottom of Drive and turn Motor until the lobes are within 90% of each other. Tighten Motor screws and recheck Radial alignment.

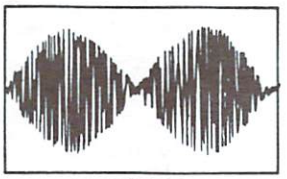


FIGURE 2

AZIMUTH CHECK

Use the same scope connections and setup used in Radial Head Alignment. Set scope sweep to .5msec. Set Drive Head to Track 34 (see "Alignment Test Setup"). Insert Alignment Diskette into Drive and connect a jumper from pin 7 of Connector CN4 to ground to keep Drive running. The pattern shown in Figure 3 should appear on the scope. The amplitude of bursts 1 and 4 must be equal to or less than the amplitude of bursts 2 and 3.

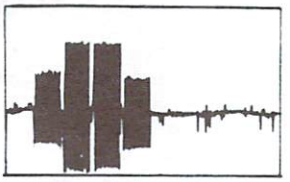


FIGURE 3

TRACK 00 STOP ADJUSTMENT

Connect the input of a scope to TP1 (pin 3 of IC U12). Set scope sweep time to 5us, voltage range to 2V/cm and scope input to AC input. Set Drive Head to Track 00 (see "Alignment Test Setup"). Insert Alignment Diskette into Drive and connect a jumper from pin 7 of Connector CN4 to ground to keep Drive running. Verify that the Head is on Track 00 by checking for the 125 KHz waveform shown in Figure 4.

With the Head on Track 00, loosen two screws holding the Track 00 Stop and adjust the Stop for a clearance of .006 inch between the Stop and the raised cam on Head Position Motor pulley (see Figure 5).

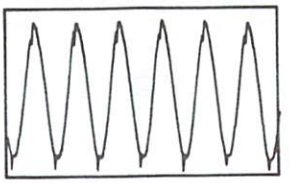


FIGURE 4

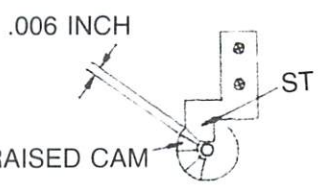


FIGURE 5

DISASSEMBLY INSTRUCTIONS

Remove four screws from cabinet bottom which hold cabinet top. Lift cabinet top from unit. Pull knob from front of unit. Lift up on the front panel and pull it forward. Remove one screw from front panel holding LED Board. Disconnect Connectors CN2, CN3 and CN4 from Main Board. Remove four screws holding Drive Mechanism to cabinet bottom and remove mechanism. Remove three screws holding Main Board and remove board.

SWITCHES

DISK DRIVE DEVICE NUMBER

The number 8 used in the load and save procedures is the device number assigned to the Disk Drive. The device number can be set to any number from 8 to 11 by setting Device switch SW2 on rear of Disk Drive. The switch closest to the Serial Interface connectors is SW2-1. The up position is On, down is Off. Use the following chart to determine switch settings for desired device number.

DEVICE NUMBER	SWITCH SW2-1	SWITCH SW2-2
8	ON	ON
9	OFF	ON
10	ON	OFF
11	OFF	OFF

CD20

COMMODORE MODEL 1541-II

GENERAL OPERATING INSTRUCTIONS

DIRECTORY

To get a Directory (list of programs on a diskette) type LOAD "$",8 and press the RETURN key. After the Directory is loaded, type LIST and press the RETURN key to list the Directory on the Monitor screen.

INITIALIZING THE DRIVE (RESET)

To initialize the Disk Drive, type OPEN 15,8,15,"I":CLOSE 15 and press the RETURN key. If a FILE OPEN error message appears on the screen, it means that file 15 has been already opened by a previous operation and was not properly closed. Type CLOSE 15 and press the RETURN key, then repeat the initializing procedure.

LOADING PROGRAMS

To load a program from the Disk Drive, type LOAD with the Program Name enclosed in quotes, followed by a ,8 and press the RETURN key. Example: LOAD "SAMS" ,8.

SAVING PROGRAMS

To save a program to the Disk Drive, type SAVE with the Program Name enclosed in quotes, followed by a ,8 and press the RETURN key. Example: SAVE "SAMS" ,8.

FORMATTING A DISKETTE

A blank diskette must be formatted before it will work in the Disk Drive. To format a diskette, insert a blank diskette into the Disk Drive and close the door. Type the following with a name for the diskette and a two character identification code enclosed in the quotes with NO:. Then, press the RETURN key. Example: OPEN 1,8,15,"NO:NAME,ID"CLOSE 1

DISK DRIVE ERROR SIGNAL (BLINKING LED)

If the LED (RED) (CR20) on the front panel of the Disk Drive starts blinking, it means an error in operation has occurred and an error message has been stored in the Disk Drive memory. Use the following program to read and display the error message. The program displays the error number, message, track and sector where the error has occurred.

```
10 OPEN 15,8,15
20 INPUT #15,EN,E$,T,S
30 PRINT "ERROR #";EN,E$
40 PRINT "TRACK #";T,"SECTOR #";S
50 CLOSE 15
```

MISCELLANEOUS ADJUSTMENTS

CLOCK FREQUENCY

Connect input of a frequency counter to pin 21 of Gate Array IC (U10). Adjust Trimmer C11 for a frequency of 16.0MHz.

HEAD CLEANING INSTRUCTIONS

Use a lint free cloth or swab dampened with 91% isopropyl alcohol to clean disk drive heads and dry with a lint free cloth.

PARTS LIST AND DESCRIPTION

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.	NTE PART No.	ECG PART No.	TCE PART No.	ZENITH PART No.	NOTES
MOTOR CONTROL BOARD						
D1						
IC1	BA6301					
TR1	2SA937M	NTE17	ECG17	SK3912	121-879 *	
TR2	2SB1009P	NTE185	ECG185	SK3191/185	121-Z9002	
TR3	2SC2021R	NTE16	ECG16	SK3911	121-Z9065 *	
MAIN BOARD						
U1	M74LS08P	NTE74LS08	ECG74LS08	SK74LS08	HE-443-780	
U2	M74LS42P	NTE74LS42	ECG74LS42	SK74LS42	HE-443-807	
U3	6502AD	NTE6502	ECG6502			
U4	251968-03					
U5	LC3517A-15					
U6	6522					
U7	M53206P	NTE7406	ECG7406	SK7406	HE-443-698	
U8	6522					
U9	M74LS04P	NTE74LS04	ECG74LS04	SK74LS04	HE-443-755	
U10	251828-01					
U11	M74LS86P	NTE74LS86	ECG74LS86	SK74LS86	HE-443-891	
U12	CX20185					
U13	UPA2003C [uPA2003C]					
U14	M74LS14P	NTE74LS14	ECG74LS14	SK74LS14	HE-443-872	

\# For SAFETY use only equivalent replacement part.
* Lead configuration may vary from original.

WIRING DATA

Shielded Hook-up Wire ..... Use BELDEN No. 8401 or 8421 (Single-Conductor)
8208 (Two-Conductor)
General-use Unshielded Hook-up Wire ..... Use BELDEN No. 8529 (Solid) Available in 13 Colors
8522 (Stranded) Available in 13 Colors
Shielded Hook-up Wire (Disk Drive Heads)..Use BELDEN No. 9534 (Four Conductor)

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

CAPACITORS

ITEM No.	RATING	MFGR. PART No.
C11 C12	10-25pF Trimmer 22 N750 50V 5%	

CONTROLS (All wattages 1/2 watt, or less, unless listed)

ITEM NO.	FUNCTION	RESISTANCE	MFGR. PART NO.	NOTES
VR1	Speed	20K		

RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	
R12 R15	68K 1% 1/4W Carbon Film .68 5% 3W Metal Film			

MISCELLANEOUS

ITEM No.	PART NAME	MFGR. PART No.	NOTES
FB5	Ferrite Bead		
L1	RF Choke 330uH		
LED1	LED		Power (Red)
LED2	LED		Activity (Green)
M1	Motor		Head Position
M2	Motor		Drive
M3	Detector		Write Protect
M5	Read/Write Head		
SW1	Switch		Rocker (Power)
SW2	Switch		Dip
Y1	Crystal		16MHz
	Power Supply	312551-01	Model 1541-II

LOGIC CHART

PIN NO	IC U1	IC U2	IC U3	PIN NO	IC U3
1	L	P	L	21	L
2	L	P	H	22	P
3	L	P	P	23	P
4	P	H	P	24	P
5	P	H	*	25	P
6	P	H	H	26	P
7	L	P	P	27	P
8	L	L	H	28	P
9	L	P	P	29	P
10	L	P	P	30	P
11	H	P	P	31	P
12	H	P	P	32	P
13	H	P	P	33	P
14	H	P	P	34	P
15		P	P	35	*
16		H	P	36	*
17			P	37	P
18			P	38	P
19			P	39	P
20			P	40	H

PIN NO	IC U4	PIN NO	IC U4
1	H	21	P
2	P	22	P
3	P	23	P
4	P	24	P
5	P	25	P
6	P	26	P
7	P	27	H
8	P	28	H
9	P		
10	P		
11	P		
12	P		
13	P		
14	L		
15	P		
16	P		
17	P		
18	P		
19	P		
20	L		

PIN NO	IC U5	PIN NO	IC U5
1	P	21	P
2	P	22	P
3	P	23	P
4	P	24	H
5	P		
6	P		
7	P		
8	P		
9	P		
10	P		
11	P		
12	L		
13	P		
14	P		
15	P		
16	P		
17	P		
18	P		
19	P		
20	P		

PIN NO	IC U6	PIN NO	IC U6
1	L	21	P
2	L	22	P
3	L	23	P
4	L	24	H
5	L	25	P
6	L	26	P
7	L	27	P
8	L	28	P
9	L	29	P
10	P	30	P
11	P	31	P
12	P	32	P
13	L	33	P
14	P	34	H
15	L	35	P
16	L	36	P
17	P	37	P
18	H	38	P
19	H	39	H
20	H	40	P

PIN NO	IC U7	IC U8	PIN NO	IC U8
1	P	L	21	P
2	P	P	22	P
3	P	P	23	P
4	P	P	24	H
5	P	P	25	P
6	P	P	26	P
7	L	P	27	P
8	P	P	28	P
9	P	P	29	P
10	H	P	30	P
11	L	P	31	P
12	P	H	32	P
13	L	P	33	P
14	H	H	34	H
15		L	35	P
16		H	36	P
17		P	37	P
18		H	38	P
19		H	39	P
20		H	40	P

PIN NO	IC U9	IC U10	PIN NO	IC U10
1	P	H	21	P
2	P	P	22	P
3	P	P	23	P
4	P	P	24	P
5	P	P	25	L(1)
6	P	P	26	L(1)
7	L	P	27	*(1)
8	H(7)	P	28	L(1)
9	L(6)	P	29	P
10	P	L	30	H
11	P	L(1)	31	P
12	P	L(1)	32	L
13	P	H(12)	33	L
14	H	H(7)	34	P
15		L	35	P
16		H	36	P
17		P	37	P
18		H	38	P(18)
19		P	39	P
20		L	40	P

LOGIC CHART (Continued)

PIN NO	IC U11	PIN NO	IC U13	IC U14
1	P	1	L	P
2	P	2	L(1)	P
3	P	3	L(1)	L
4	P(18)	4	*(1)	H
5	H	5	L(1)	P
6	P(19)	6	H(12)	P
7	L	7	L	L
8	P	8	L	H
9	H	9	H	L
10	P	10	*	H
11	P	11	L(13)	L
12	H	12	H(1)	L
13	P	13	L(1)	H
14	H	14	H(1)	H
15		15	H(1)	
16		16	*	

NOTE:

Voltages, Waveforms and logic readings for Disk Drive Interface taken while running the follwing Basic program. Readings were taken when the disk drive head is not moving (drive is in read or write mode) unless noted.

NOTE: Insert a formatted diskette (not write protected) in Drive before running the program.

```
10 OPEN 3,8,3,"@0:SAMS,S,W"
20 FOR X=1 TO 50
30 PRINT#3, "HOWARD W SAMS"
40 NEXT X
50 CLOSE 3
60 GOTO 10
```

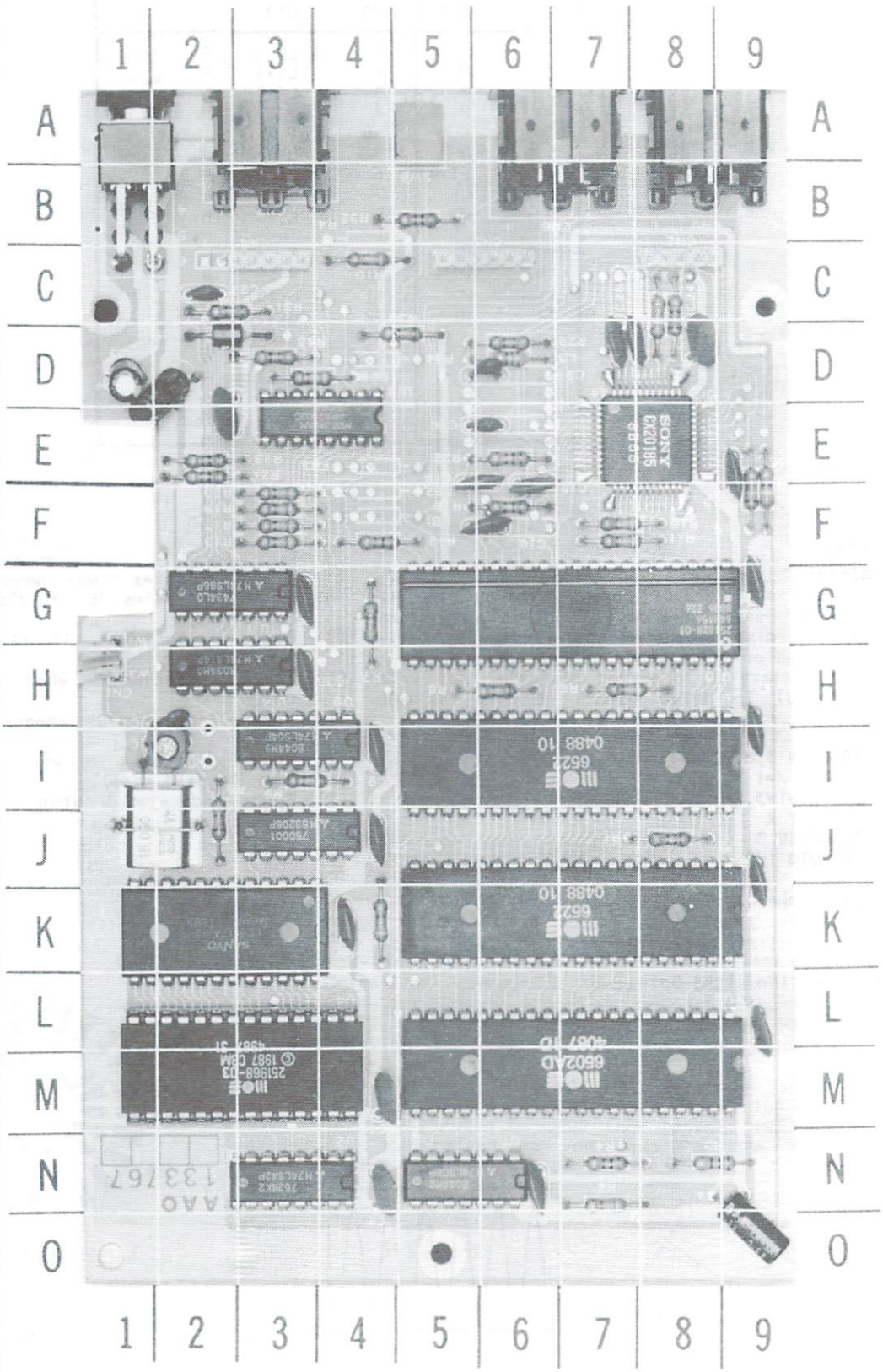
Logic Probe Display
L = Low
H = High
P = Pulse
* = Open (No light On)

(1) Probe indicates P when Head is moving.
(6) Probe indicates H if diskette is write protected.
(7) Probe indicates L if diskette is write protected.
(12) Probe indicates L when drive motor is Off.
(13) Probe indicates H when drive motor is Off.
(18) Probe indicates H when wirte mode, L when is read mode.
(19) Probe indicates L when in write mode, H when in read mode.

MAIN BOARD GridTrace LOCATION GUIDE

C1	N-6
C2	N-4
C3	O-9
C4	M-4
C5	L-9
C6	K-4
C7	J-9
C8	J-4
C9	I-4
C10	I-9
C11	I-12
C12	H-2
C13	G-3
C14	G-9
C15	E-9
C16	F-6
C17	F-6
C18	E-6
C19	E-2
C20	E-6
C21	D-6
C22	D-2
C23	D-1
C24	D-8
C25	D-7
C26	D-7
C27	C-2
C28	H-3
CN2	C-8
CN3	C-6
CN4	C-3
CN5	A-8
CN6	A-7
CN7	A-3
FB5	D-2
L3	D-6
R1	J-8
R2	N-7
R3	N-8
R4	N-7
R5	J-2
R6	H-7
R7	G-4
R8	H-6
R9	I-3
R10	C-4
R11	F-7
R12	F-4
R13	F-3
R14	F-9
R15	F-9
R16	F-7
R17	F-3
R18	F-6
R19	F-3
R20	F-3
R21	E-2
R22	E-6
R23	E-2
R26	D-3
R27	C-8
R28	C-8
R29	D-6
R30	D-5
R31	C-2
R32	B-5
R42	K-4
R43	D-3
SW1	A-1
SW2	A-5
U1	N-5
U2	N-3
U3	M-7
U4	M-3
U5	K-3
U6	K-7
U7	J-3
U8	I-7
U9	I-3
U10	G-7
U11	G-3
U12	E-8
U 13	E-4
U14	H-3
Y1	J-1

MAIN BOARD



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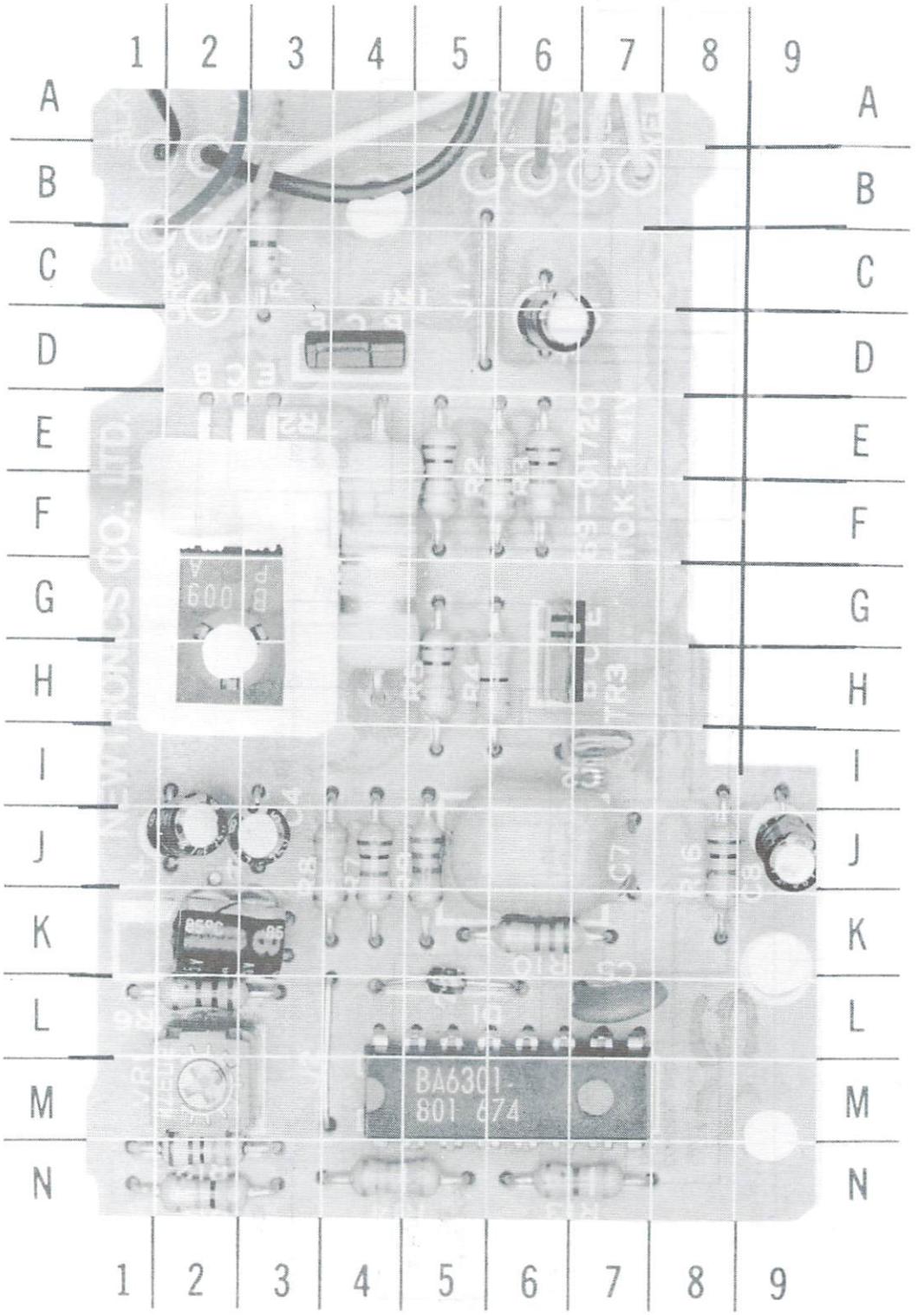
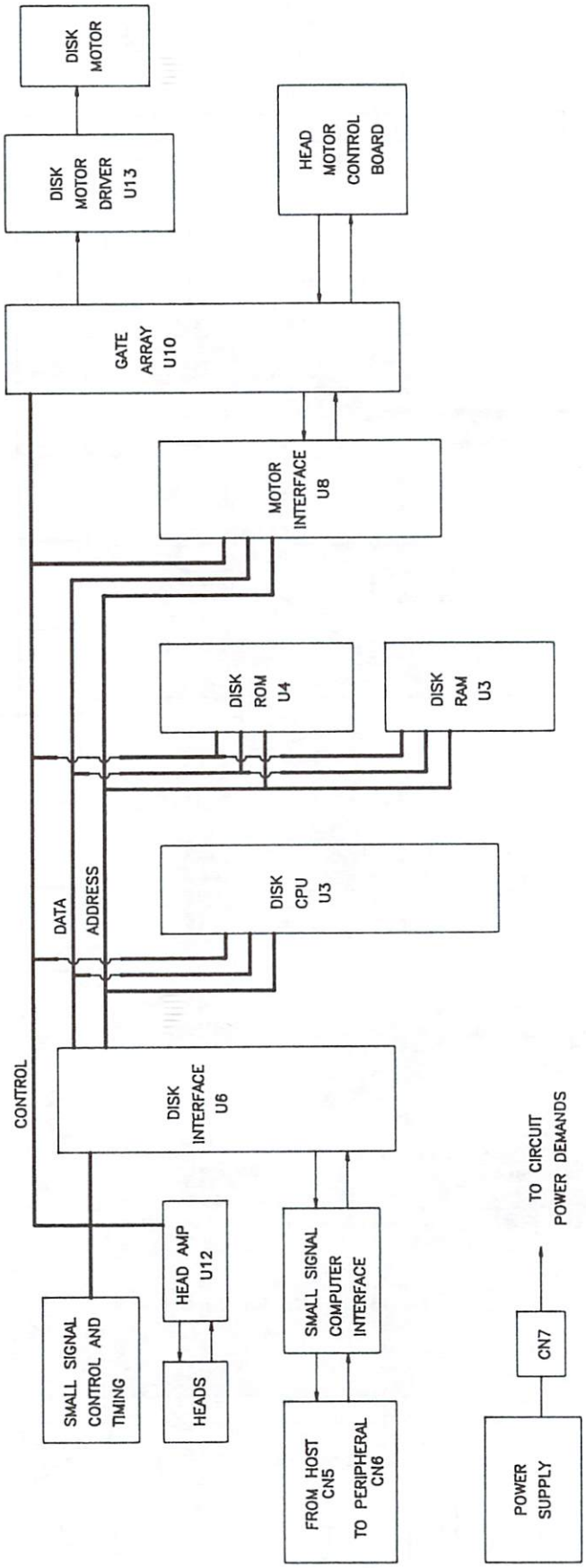
MOTOR CONTROL BOARD GridTrace LOCATION GUIDE

C1	D-6	R1	E-5	R11	N-2
C2	I-7	R2	E-6	R12	N-2
C3	J-2	R3	E-6	R13	N-7
C4	J-3	R4	H-5	R15	F-4
C5	L-7	R5	H-5	R16	J-8
C6	K-2	R6	L-2	R17	C-3
C7	J-6	R7	J-4	TR1	D-4
C8	J-9	R8	J-4	TR2	G-2
D1	L-5	R9	J-5	TR3	H-6
IC1	M-5	R10	K-6	VR1	M-2



MOTOR CONTROL BOARD



BLOCK DIAGRAM

LINE DEFINITIONS

A0 THRU A15 ..... Address Bits 0 Thru 15
ATN ..... Attention, Serial I/O Port Recognition
B0-B7 ..... Address Bits 0 Thru 7
CLR ..... Clear
CS6 ..... Chip Select 6
CS8 ..... Chip Select 8
D0-D7 ..... Data Bits 0 Thru 7
DS0 ..... Drive Select 0
DS1 ..... Drive Select 1
IRQ ..... Interrupt Request
MTR ..... Motor Control
PB4 ..... Port B, Bit 4
R/W ..... Read/Write
RES ..... Reset
SOUTEN ..... Serial Out Enable
STP0 ..... Step 0
STP1 ..... Step 1
WDATA ..... Write Data
WGATE ..... Write Gate
WPROT ..... Write Protect

SCHEMATIC NOTES

—*— Circuitry not used in some versions
--- Circuitry used in some versions
θ See Parts List
⏚ Ground
Chassis
▽ Common tie point

Waveforms and voltages taken from ground, unless notes otherwise. Waveforms taken with triggered scope and Sweep/Time switch in Calibrate position, scope input set for DC coupling on 0 reference voltage waveforms. Switch to AC input to view waveforms after DC reference is measured when necessary. Each waveform is 7cm. width with DC reference voltage given at the bottom line of each waveform.

Time in uSEC. per cm, given with p-p reading at the end of each waveform.

Item numbers in rectangles appear in the alignment/adjustment instructions.

Supply voltages maintained as shown at input.

Voltages measured with digital meter, no signal.

Terminal identification may not be found on unit.

Capacitors are 50 volts or less, 5% unless noted.

Electrolytic capacitors are 5 volts or less, 20% unless noted.

Resistors are 1/2W or less, 5% unless noted.

Value in () used in some versions.

Measurements with switching as shown, unless noted.

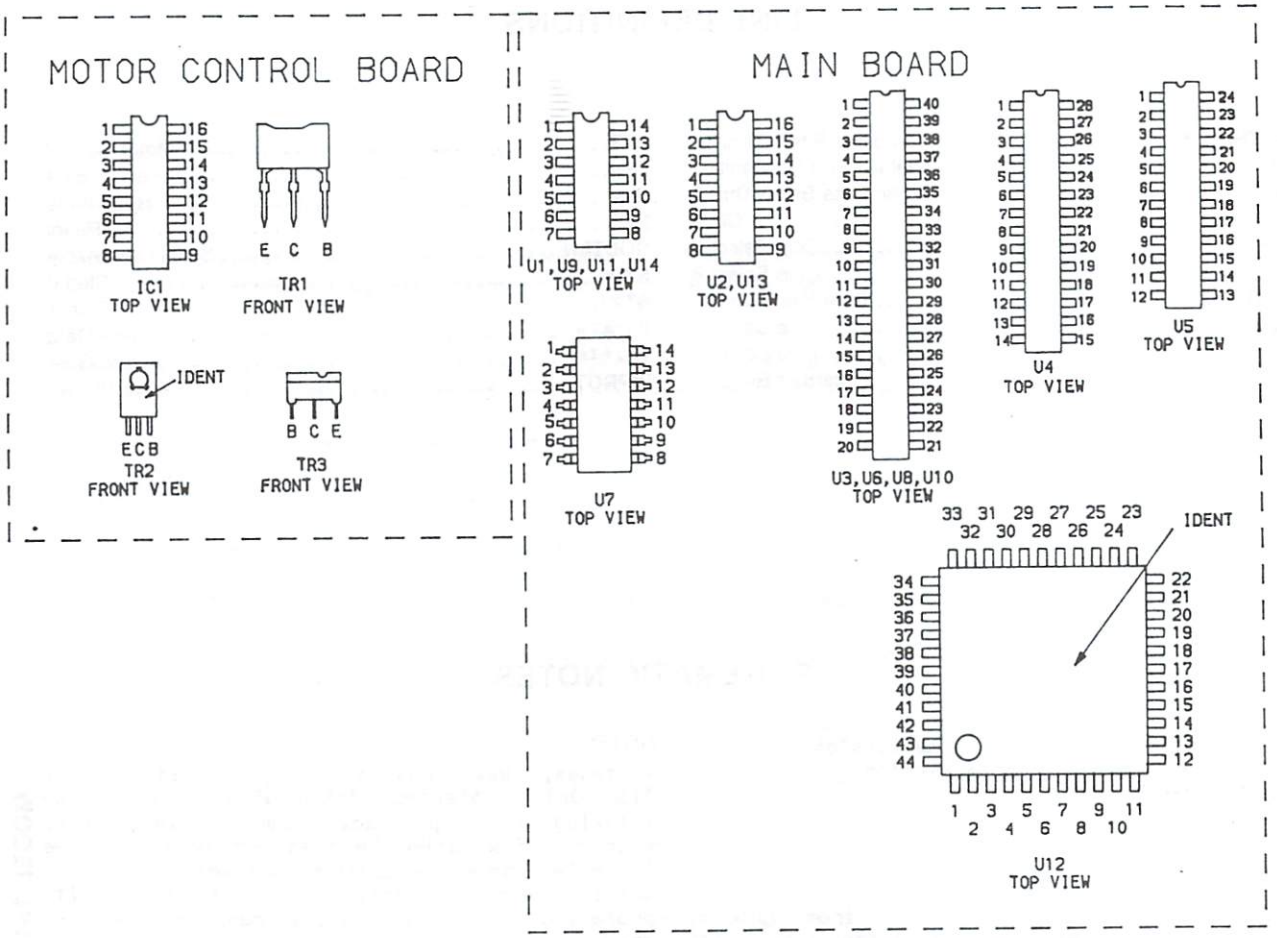
NOTE:
Voltages, Waveforms and logic readings for Disk Drive Interface taken while running the follwing Basic program. Readings were taken when the disk drive head is not moving (drive is in read or write mode) unless noted.
NOTE: Insert a formatted diskette (not write protected) in Drive before running the program.

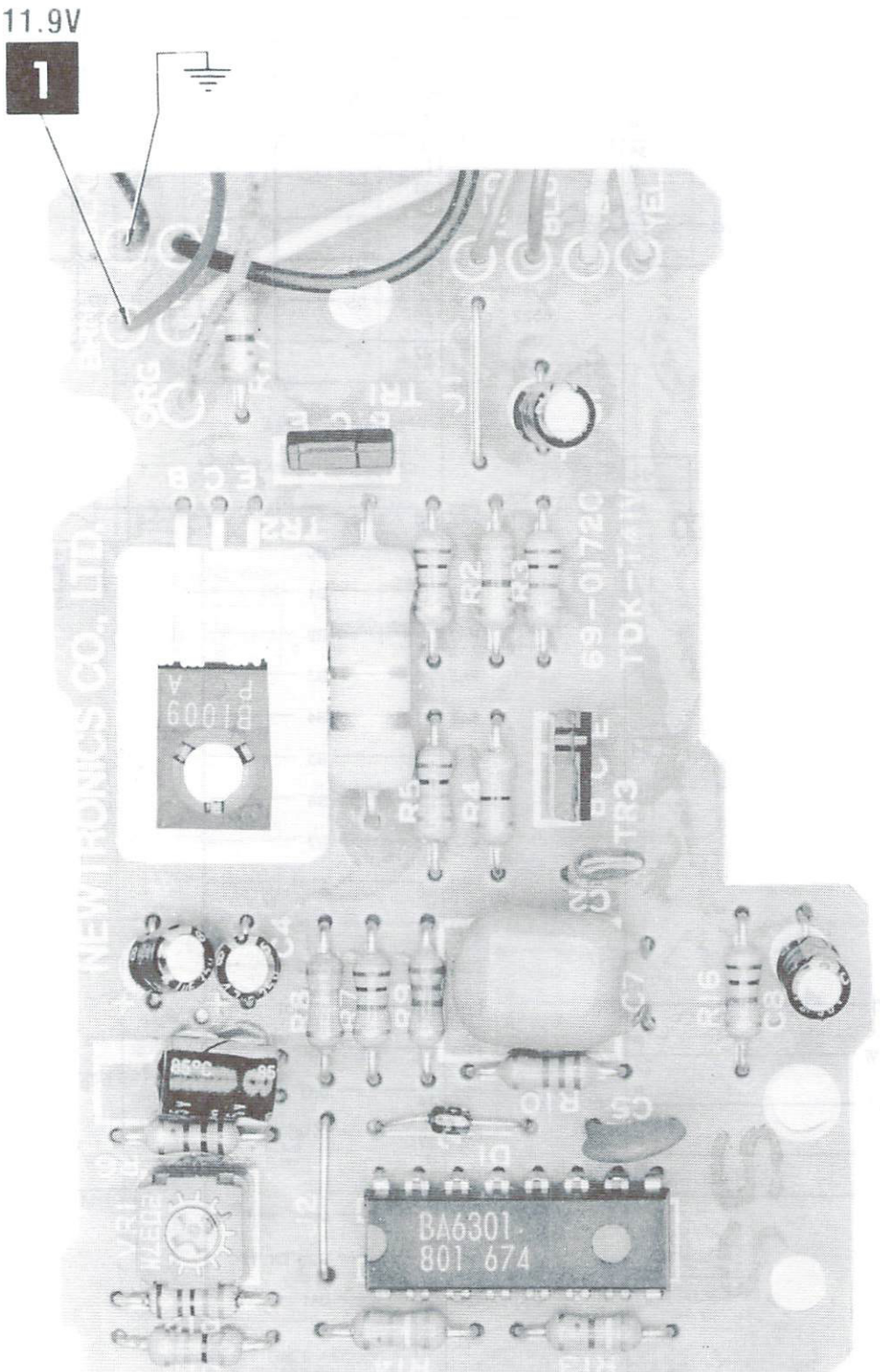
```
10 OPEN 3,8,3,"@0:SAMS,S,W"
20 FOR X=1 TO 50
30 PRINT#3, "HOWARD W SAMS"
40 NEXT X
50 CLOSE 3
60 GOTO 10
```

Logic Probe Display
L = Low
H = High
P = Pulse
* = Open (No light On)

(1) Probe indicates P when Head is moving.
(6) Probe indicates H if diskette is write protected.
(7) Probe indicates L if diskette is write protected.
(12) Probe indicates L when drive motor is Off.
(13) Probe indicates H when drive motor is Off.
(18) Probe indicates H when wirte mode, L when is read mode.
(19) Probe indicates L when in write mode, H when in read mode.

TERMINAL GUIDES





MOTOR CONTROL BOARD

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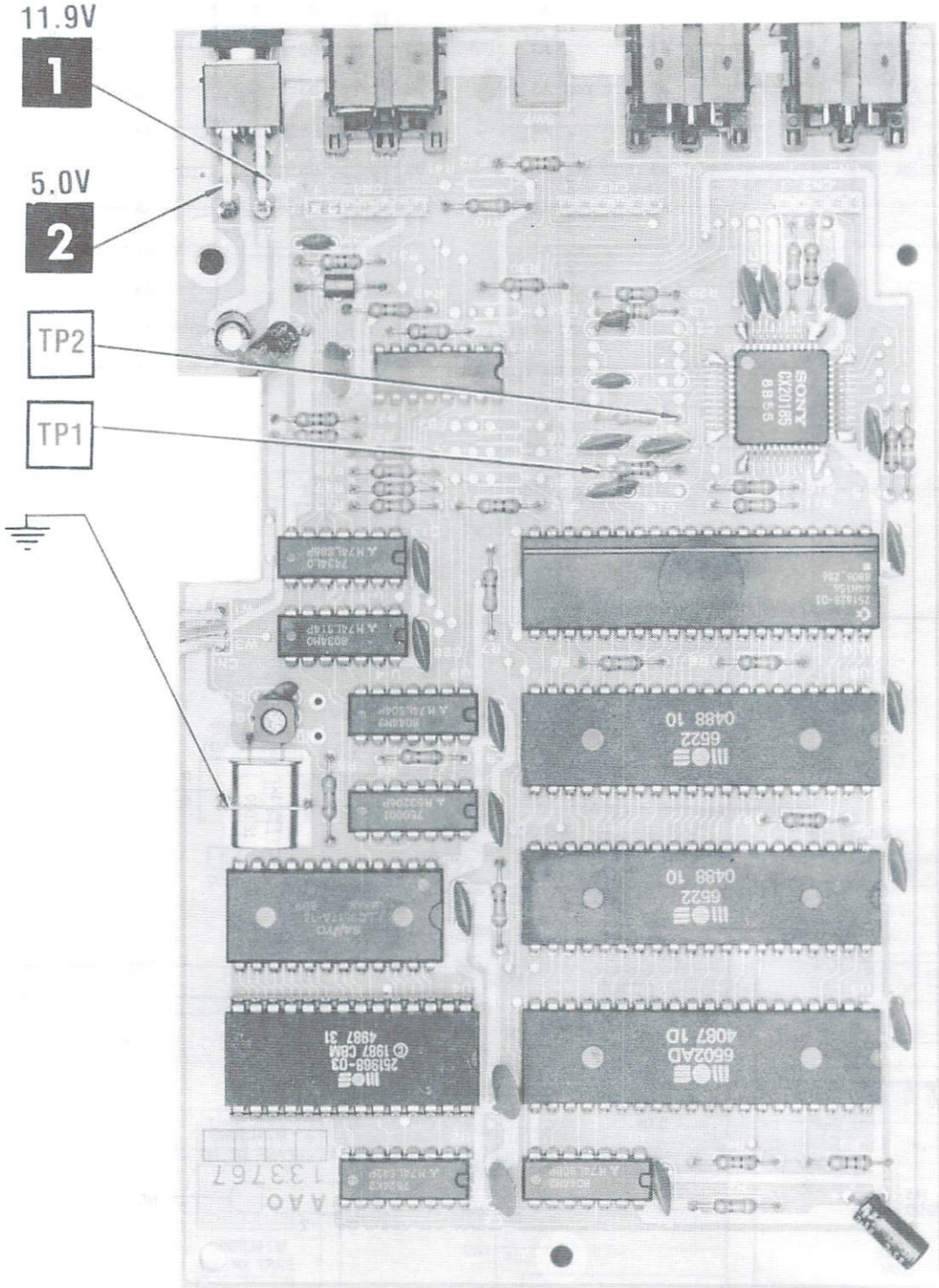
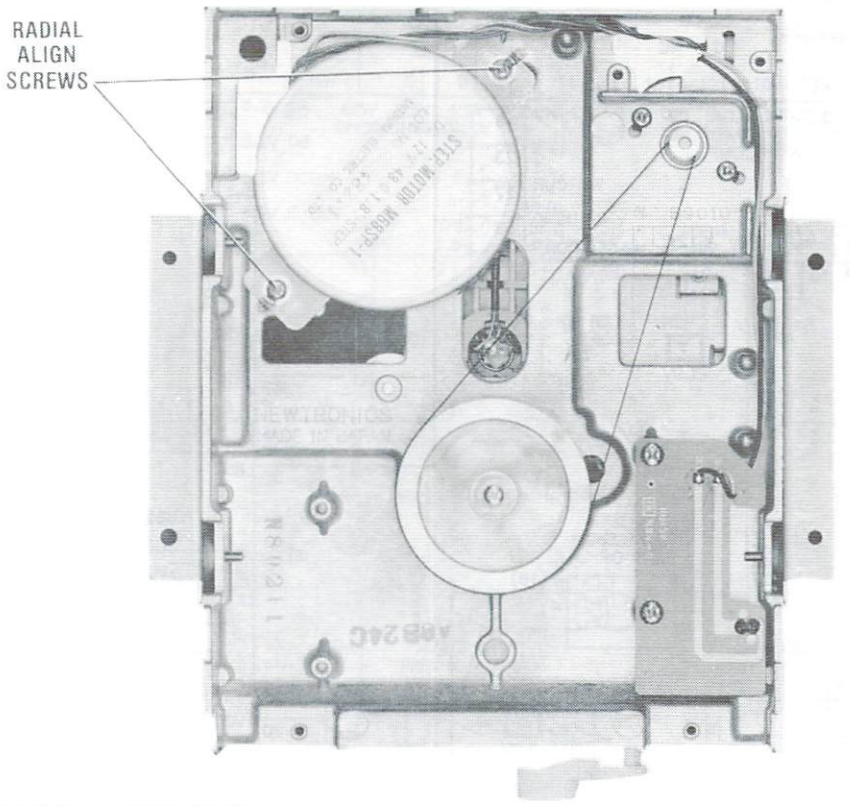
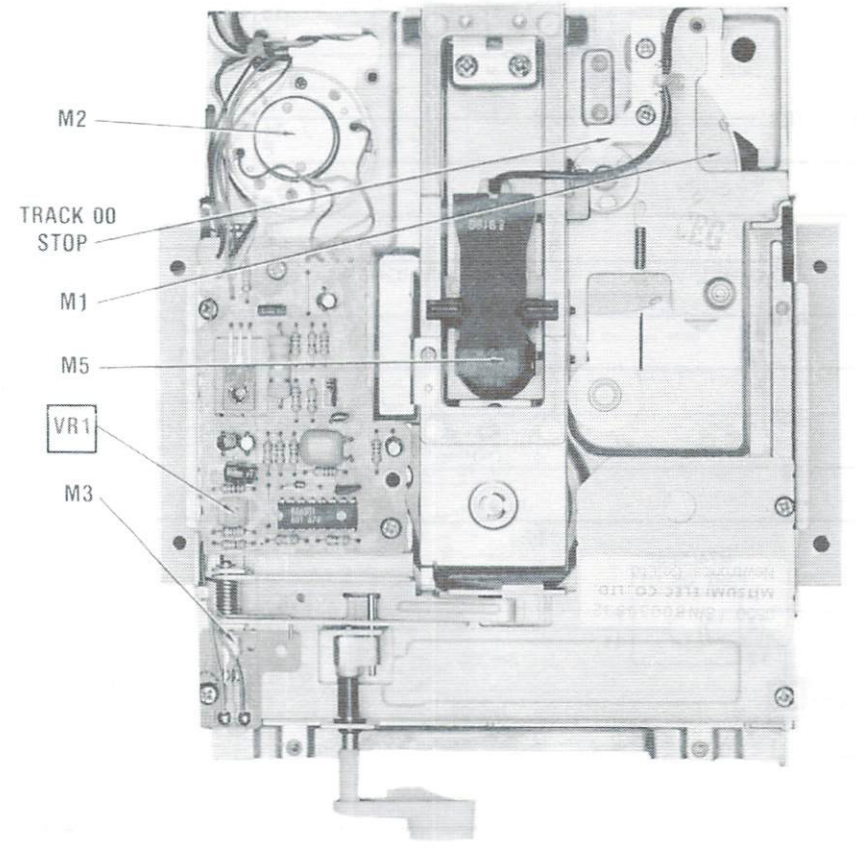


MAIN BOARD

A Howard W. Sams CIRCUITRACE® Photo



MECHANICAL-TOP VIEW



MECHANICAL-BOTTOM VIEW

CD20

COMMODORE MODEL 1541-II

HOWARD W. SAMS & COMPANY

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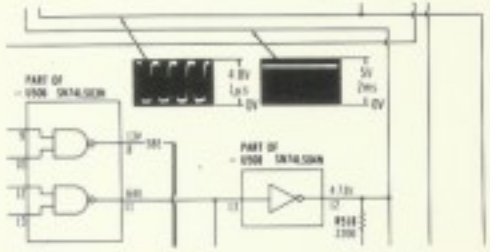
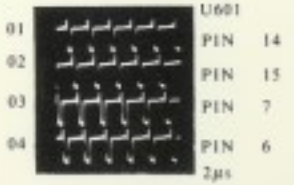


- Step by Step Troubleshooting guides the technician through the necessary procedures to quickly locate the problem.

TROUBLESHOOTING

MICROPROCESSOR CHIP (CPU) OPERATION

Verify the processor is functioning by checking the signals on the address lines (pins 10 thru 24 of IC U600) and the data lines (pins 41 thru 56) using a logic probe or a scope if a logic probe is used, refer to the "Logic Chart" for the correct readings. If a scope is used, the waveforms on the address lines (except pins 22 and 23 which have no signal in Power Up mode) should be similar to Figure 1. The waveforms on the data lines should be similar to Figure 2.

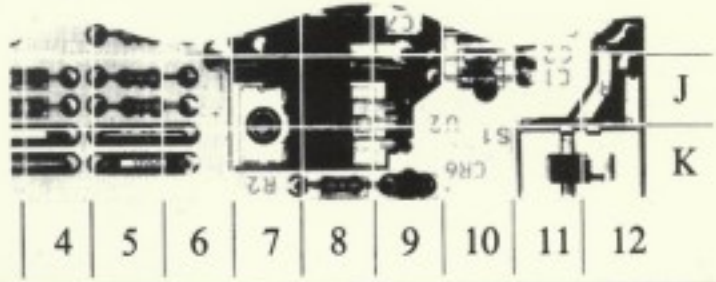


- Logic Chart containing logic probe readings to isolate defective circuitry and components.

LOGIC

PIN NO	IC U100	PIN NO	IC U100	PIN NO	IC U102	IC U103	IC U104	IC U105	IC U106	IC U107	IC U108	IC U109
1	P	21	P	1	L	L	L	L	L	L	L	L
2	P	22	P	2	P	P	P	P	P	P	P	P
3	P	23	P	3	H	H	H	H	H	H	H	H

- Quick Component Location using the SAMS exclusive GRIDTRACE, CIRCUITRACE, and component photographs.



- Complete Components Parts List in an easy to use format with field replacements shown when possible. SAMS unique semiconductor, chip and IC cross-reference gives you many replacements to choose from and is available at your Electronic Distributor.

SEMICONDUCTORS (Select replacement for best results)

			REPLACEMENT DATA				
ITEM No.	TYPE No.	MFGR. Part No.	ECG Part No.	NTE Part No.	RCA Part No.	ZENITH Part No.	NOTES
D102	1S553	1149-2576	ECG519	NTE519	SK9091/177	103-131	
D103	2N60FM	1149-2527	ECG109	NTE109	SK3088	103-Z9001	
D201	1N4004GP	1201-4205	ECG116	NTE116	SK3312	212-76-02	
D501 thru D503	1S553	1149-2576	ECG519	NTE519	SK9091/177	103-131	

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ISBN: 0-672-09038-4